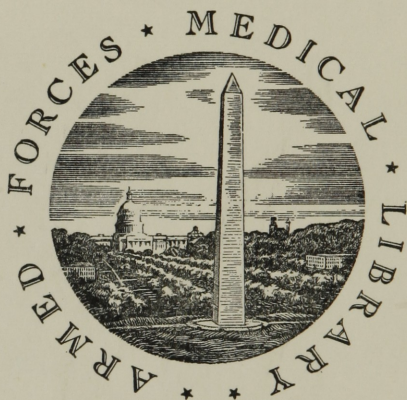


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John R. Coxe. 1794 -

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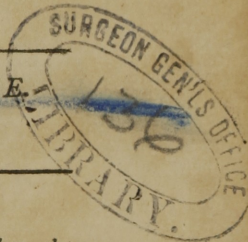
I N A U G U R A L

E S S A Y

ON

I N F L A M M A T I O N,

By JOHN REDMAN COXE.
OF PHILADELPHIA.



"In the first steps of our Inquiry, we meet indeed with much variety and obscurity; but the further we penetrate into Nature, we find so much analogy amongst her works, as to be forced to acknowledge and to revere her simplicity."

PRINGLE ON THE DISEASES OF THE ARMY,
SEVENTH EDITION, p. 223.

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A N
I N A U G U R A L E S S A Y

SUBMITTED TO THE EXAMINATION

O F T H E

REV: JOHN EWING, S.T.P. PROVOST;

T H E

Trustees and Medical Faculty

O F T H E

UNIVERSITY OF PENNSYLVANIA;

FOR THE DEGREE OF

DOCTOR OF MEDICINE

ON THE NINETEENTH OF MAY

1794.

JOHN REDMAN, M.D.

PRESIDENT OF THE COLLEGE OF PHYSICIANS
OF PHILADELPHIA.

MY DEAR FRIEND,

RECEIVING as well as daily prompt
me to believe that my first medical attempt, in your
case, has been a thoroughly successful one, through life,
not only in your progress, but also in the public
and domestic duties which your character has so
abundantly and so long sustained.

With every wish for your continued health and

happiness,

I remain, my friend,

Yours very truly,

JOHN REDMAN

Physician in Chief, St. George's Hospital,
London.

DOCTOR OF MEDICINE
JOHN REDMAN COZE

PHILADELPHIA, MAY 15, 1841.

OF THE UNIVERSITY OF PENNSYLVANIA

1841

TO JOHN REDMAN, M. D.

PRESIDENT OF THE COLLEGE OF PHYSICIANS
OF PHILADELPHIA.

MUCH HONOURED SIR,

INCLINATION as well as duty would prompt me to dedicate this, my first medical attempt, to you, who have so eminently distinguished yourself through life, not only in your profession, but also in those other public and domestic duties which adorn your character both as a man and as a christian.

WITH every wish for your continued health and happiness,

I subscribe myself

Much honoured Sir,

Your dutiful and

Affectionate Grand Son,

JOHN REDMAN COXE.

PHILADELPHIA, MAY 13, 1794.

TO BENJAMIN RUSH, M. D.

PROFESSOR OF THE INSTITUTES, AND OF CLINICAL
MEDICINE, IN THE

UNIVERSITY OF PENNSYLVANIA.

DEAR SIR,

PERMIT me to lay before you also, the first fruits
of those studies which commenced under your direction,
as a small tribute of grateful respect from one, on whom
you have conferred so many obligations.

With the most sincere wishes for your prosperity,

I subscribe myself

Dear Sir your

Affectionate and

Grateful pupil,

JOHN REDMAN COXE.

PHILADELPHIA MAY 13, 1794.

INQUIRY, &c.

OF THE NATURE AND CAUSES OF INFLAMMATION

IN THE

UNIVERSITY OF PENNSYLVANIA
BEFORE I proceed to consider the subject of inflammation, it may not be improper to take a view of certain phenomena occurring in the system, which I shall hereafter shew to be intimately connected with it, as they tend to elucidate many of its symptoms, and in a more satisfactory manner, I hope, than has been hitherto done by any theory.

The phenomena alluded to, are ANIMAL HEAT: and the RED COLOUR of the BLOOD. And here I do not mean to enter into a long detail of the theories which have been brought forward to account for the causes of those interesting and curious operations of nature; as it would far exceed the limits of this dissertation, and as many authors have repeatedly stated upon it. I shall content myself, in stating the method I suppose to be employed by nature to effect her purpose, with my reasons for the opinion, after which I shall proceed to treat of inflammation, and shew the place which they hold in this curious process of the diseased animal economy, made use of by nature to regain her empire in the system. — And here, in speaking of nature, I say it

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I N Q U I R Y, &c.

BEFORE I proceed to consider the subject of inflammation, it may not be improper to take a view of certain phænomena occurring in the system, which I shall hereafter shew to be intimately connected with it, as they tend to elucidate many of its symptoms, and in a more satisfactory manner, I hope, than has been hitherto done by any theory.

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* P. D. Leslie and others.

may by no means be supposed, that I believe in the operations of a *VIS MEDICATRIX*, which I utterly discard.—I use the term for want of a better to express the effects of natural causes upon our systems.

I shall first say a few words upon the blood itself; by which I mean,—That fluid, which circulates in the human body, by means of the arteries and veins; is of a red colour; and appears to be one homogeneous mass whilst warm and in motion; and which supports life, by affording every part of the body its peculiar nutritive portion.

In tracing the blood through its circulation, we are struck with finding the difference in its qualities in the arteries and veins—this difference consists,

1. In its being of a more fluid consistence, in the arteries than in the veins.
2. Its intensity of colour being greater, in the arteries than in the veins.
3. In the arterial blood putrefying much sooner than venous.

We are also struck with the difference of its temperature in different species of animals; some having it warmer, and others colder than the medium in which they live.

A person is naturally led to wish to inform himself of the process by which nature accomplishes these curious phenomena.—I shall therefore as a step towards

an investigation of their causes, proceed to say something on each part of the blood.

Although blood appears to be whilst circulating in the body, a perfectly homogeneous fluid; yet by letting it stand for some time when drawn from a vein, we find it separate into two portions; called serum or lymph; and crassamentum or cruor. The last is further separable into coagulable lymph or gluten; and red globules.

OF THE SERUM.

This is of a transparent yellowish colour; remaining fluid in the temperature of the atmosphere,—but coagulating in the 160° of Fahrenheit's thermometer.—It seems to be this part of the blood which is peculiarly appropriated for the various secretions in the human body; this I infer from finding it in a much smaller proportion in the blood of healthy people, whose secretions go on properly, than in those of lax and debilitated habits, in whom this function is imperfectly performed.

OF THE CRASSAMENTUM.

This I said above was divided into gluten and red globules. The former may be obtained either by washing away the red globules, by repeated affusions of water, or by collecting it on a stick by stirring up the blood whilst warm; it may be rendered perfectly white by washing, and appears to be of a fibrous structure, whence it has been called the fibrous part of the blood. This portion of the blood appears to be more particularly

larly serviceable in the formation and growth of the body; which I infer from observing its use in wounds and fractures, which never heal, till by the affusions of this substance, as granulations or callus, a bed is formed for the elongation of the vessels; or until the force of the circulation in the ruptured vessels is sufficient of itself to form a cavity in it.—This part of the blood is in greater proportion in healthy, strong and robust habits, than in those of an opposite one.

OF THE RED GLOBULES.

This portion of the blood bears an important part in the animal œconomy; their particular use has, I believe never been much noticed; it will I hope appear in the course of the following inquiry. A few words upon the subject of respiration will be proper to prepare us for the more easy discussion of this subject.

It is well known that vital air is absolutely necessary in the process of respiration; and that our existence is soon terminated without its invigorating action upon the lungs; yet, as by itself it would prove too stimulating to our systems, another species of air is combined with it, in the proportion of nearly three fourths, which sufficiently abates its excessive stimulus; this combination forms the common atmospheric air, which descending into the lungs in the act of inspiration, the vital or oxygenous portion is by some peculiar, unknown animal process, or perhaps by some chemical affinity, decomposed; by which wonderful operation of the animal œconomy, we are fitted to produce that vivifying principle HEAT; which in the animal body is

known

known by the name of ANIMAL HEAT:—This decomposition takes place, either in the lungs themselves; or in the instant of its combining with the blood: it must be effected in one of these ways, as air cannot exist in a formal state in the blood vessels; for various experiments prove that injecting a small quantity of even pure air into them, causes almost instant death.

That the oxygen gas is separated from the other portion of air, and decomposed, is evident, from,

1. The absolute necessity of this species of air to animal life.

2. From a given quantity sustaining life but a certain time.

3. The gas emitted by expiration is a mixture of nitrogen gas, carbonic acid gas, and vital air; the former of these exists in an undiminished proportion.

4. If this were not the case, the same quantity or portion of air would be fully adequate to the purposes of respiration for ever; and if some peculiar vivifying principle did not exist in the oxygenous portion of the air, we could with equal ease respire the azotic portion of the atmosphere; or even hydrogen gas; neither of which have, I believe, been found to exert any baneful influence on the animal œconomy, independently of their depriving us of the presence of oxygen; so necessary a stimulus to animal life.

From what has been stated, it will be easy to conceive in what manner death takes place from drowning, hanging,

hanging, &c. viz. from the absence of vital air in the lungs; without which respiration *cannot* go on; the blood is prevented passing through that organ, from the right to the left side of the heart; consequently it will be accumulated in the veins; as the arteries are enabled to propel their contents into them, owing to their muscular coats; this turgescence and distention must more particularly take place in the sinuses of the brain, as a greater proportion of blood is carried to that viscus than to any other part of the body; and as it cannot pass off by the jugular veins, a species of apoplexy must be induced; which will *rapidly* increase, if timely assistance cannot be procured.

Having thus rendered the decomposition of oxygen gas evident, (wherever it may take place,) I shall now proceed to speak of its influence and action upon the body in the state of its absorption and fixation; and first of the RED COLOUR of the blood; with its more florid appearance in the arteries than in the veins.

This difference of colour must take place in the lesser circulation as it is termed; or in the passage of the blood from the right to the left side of the heart, through the lungs; this is evident,

1. From finding the blood in the left ventricle of the heart, and even immediately after entering the pulmonary veins, of a much more florid appearance than that, which is in the right side and venous system.

2. The experiments of Mr. Edward Coleman, shew that after drowning or hanging an animal “the aorta

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and its branches contain a quantity of blood which in all its appearances, resembles venous".† These facts are sufficient to authorize the conclusion, and it now only remains to shew, that the cause of this curious change is the absorption of oxygene from the atmosphere: for which purpose I shall enumerate several facts and experiments tending to prove it, made by men of undoubted veracity, and quoted by Chaptal in his first volume of the elements of chemistry.

1. "If—says Chaptal, "the blackish venous blood be exposed in a pure atmosphere, it becomes of a vermilion colour at its surface: air which has remained in contact with blood, extinguishes candles, and precipitates lime water."

2. "Air injected into a determinate portion of a vein between two ligatures, renders the blood of a higher colour."

3. "Mr. Thouvenal has proved, that by withdrawing the air which is in contact with the blood, it may be again made to lose its colour."

4. "Mr. Beccaria exposed blood in a vacuum, where it remained black, but assumed the most beautiful vermilion colour as soon as it was again exposed to the air:" and "Mr. Cigna covered blood with oil, and it preserved its black colour."

5. "Dr. Priestly caused the blood of a sheep to pass successively into vital air, common air, mephitic air, &c. and he found that the blackest parts assumed a red colour in respirable air, and that the intensity of this

colour

† Coleman p. 2 and 15.

colour was in proportion to the vital air present. The same philosopher filled a bladder with blood, and exposed it to pure air. That portion of blood which touched the surface of the bladder, became red, while the internal part remained black; an absorption of air therefore took place through the bladder, in the same manner as when the contact is immediate."

6. The blood of a foetus has not that florid redness observable after birth, owing doubtless, to a want of oxygen; for the blood coming from the mother by the umbilical vein, must possess its dark colour; which would not be the case if this phenomenon depended upon some internal cause.

7. Exercise increases the florid appearance of the blood; owing to the increased respiration, by which a larger proportion of oxygen is decomposed in a given time.

8. Asthmatic people do not in general possess that florid appearance of the blood, observable in healthy people; owing to an impeded respiration.

9. "Mr. de la Metherie by accurate experiments has proved, that three hundred and sixty cubic inches of vital air are absorbed in an hour."

10. The red globules are very inflammable.

On what portion of the blood does this oxygen act to produce the red globules? This is very difficult to answer: we know that the red globules contain a large proportion of iron in the state of an oxyd; and lately

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the phosphoric acid has been said to be united with them. This iron, found to exist in them, I infer to be the product of animal organization.

1. Because we cannot otherwise account for the quantity always present in the blood; although I grant it may be taken into the system in a large quantity, during a course of chalybeates, as it may be discovered in the urine by proper tests, according to Chaptal.

2. From analogical induction. Mr. Chaptal says, "it even appears to be one of the products of organization or vegetation; for it is found in vegetables which are supported *merely* by air and water." This analogy will be much strengthened, by considering, that seeds suspended by means of cotton on the surface of *pure distilled* water, will nevertheless grow, and increase in weight; and are capable of being reduced to the state of earth; though none existed in the water itself. Whence then was it derived?

In answer to the above question, viz. what portion of the blood is acted upon to produce the red globules—I think it probable that the *serum* is the portion; and for the following reasons.

1. The great solubility of the red globules in the serum.

2. In health the serum always decreases in the inverse ratio of the increase of the red globules: hence "in a mass of healthy blood one half or upwards is red cruor; and in strong labouring people, the serum makes only a third part; and is still more diminished

in fevers, often to a fourth and fifth part of the mass,* even though the secretions are diminished at the same time. Possibly in this case, from the increased action of the system, a larger quantity of air is decomposed in a given time. But much light would be thrown on this subject, could we but obtain the oxygene or base of vital air itself, in an uncombined and separate state; for at present we can only judge of it from its effects.

3. By the addition of substances to the serum containing a large quantity of oxygene, as nitric acid, a light rose colour is produced, according to Fourcroy; here the iron does not exist in the proportion necessary to form a red colour; but there is sufficient to produce as it were a grade of it.

Having thus endeavoured to shew that the decomposition of oxygene gas, and consequent fixation of its base, are the cause of the red colour of the blood; I now proceed to prove that ANIMAL HEAT is dependant on the other principle of the oxygene gas, which is absorbed by the blood vessels, and conveyed by them, to every part of the body.

This portion, or caloric, which kept the oxygene in a gaseous state; and which is necessary to the formation of all aeriform fluids, must evidently escape from its combination, and be set at liberty at the moment of the decomposition of the vital air; and is immediately taken up by the blood, whose capacity for receiving heat is very great, and is much increased by the oxygene combined with it; now chemistry teaches us, that

* New system of Anatomy, V. 2. p. 246.

that bodies absorb heat in proportion to their capacities for receiving it.

That this is its origin and mode of conveyance, I infer from the following facts.

1. The heat in a joint and limb is diminished by the application of a ligature; or by compressing the artery: and is again restored by removing the ligature or compression.

2. The heat of a palsied limb, in which however the circulation is complete; is as great as in the opposite limb, which is not diseased.

3. The heat in each class of individual animals is proportioned to the magnitude of their lungs, according to Messrs. De Buffon, and Brouffonet.

4. Animals with cold blood have only one auricle and ventricle: Leslie says, "the difference of temperature in different classes of animals is not less intimately connected with the crasis and colour of the blood, than we have found it to be with the state of respiration: all the more perfect animals, Man, Birds and Quadrupeds, which are known to generate the highest degrees of heat, have likewise the greatest proportion of red globules in their blood: the amphibious tribe which are of an inferior temperature, have a proportional diminution in the quantity of red blood: next to these come the branchial fishes, which are still more deficient in both respects, and seemingly in an exact proportion; and lastly, those which are destitute of gills

gills, have their fluids as transparent as the element in which they live, and are nearly of the same temperature, as the species of oysters, cockles, &c.”

5. The heat is nearly, if not quite the same in every part of the body.

6. The heat of the body, is diminished by hemorrhagy.

To these facts I cannot help adding, that the theory which arises from them is more philosophical and simple, than any that has hitherto been proposed.

“ Respiration then” adds Chaptal, “ may be considered as an operation by means of which vital air passes continually from the gaseous to the concrete state: it must therefore at each instant abandon the heat which held it in solution and in the state of gas. This heat produced at every inspiration must be proportioned to the volume of the lungs, to the activity of this organ, to the purity of the air, the rapidity of the inspiration, &c.”*

The above facts easily explain why those animals which have but one auricle and one ventricle, have cold blood; and why the heat of animals is in a great measure proportioned to the volume of their lungs.—In the former case, the blood does not pass through the lungs to imbibe this vivifying principle from the atmosphere;—in the latter, the air is decomposed more speedily, and in larger quantities.

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* Chaptal V. i. p. 137.

The phenomena of respiration therefore appear to be the same, as those of combustion.

Should it be asked here what becomes of the heat which is constantly produced in the system, and why a constant renewal of it should be necessary, I answer, that it is perpetually passing from our bodies to the surrounding ones, in obedience to a law of heat, viz. its disposition to an equilibrium.—In hot climates, when the surrounding bodies are nearly of the same temperature with the human body, the heat is conveyed off by copious streams of perspiration which take place, and which, if retained, give rise to numerous distressing and painful diseases.

A similar question may be asked with respect to the destination of the large quantities of oxygene which I have asserted, constantly enter into the system; I answer, the question is difficult; that it is designed for some important end must be evident; yet perhaps little more than a conjecture can be given respecting it, in the present limited state of our knowledge; but surely in such a case, conjecture is allowable; for should it even be erroneous, it may stimulate to such inquiries as shall ultimately bring truth to light, like the splendor of the meridian luminary after dissipating by its gentle, yet powerful rays, the fogs and darkness of the preceding night.

The quantity of blood in the human body is now generally admitted to equal from thirty to fifty pounds; of which a little more than one half are said to be true red blood; which redness I have asserted to depend on the

the presence and constant renewal of the oxygen.—I need not mention that oxygen is one of the most powerful stimuli in the universe; and that not only the animal, but the vegetable kingdoms, owe their existence in a great degree to it;—this must be evident from what has been said in the preceding pages.—This immense quantity of oxygen in its passage from the heart assists in the circulation of the blood, by its stimulating action upon the muscular fibres of the heart and arteries, (exclusively of the stimulus of distention from the *whole* mass of blood;) by which a contraction of those tubes is effected.—That the blood does act upon the heart and arteries as a specific stimulus, is very evident from the following experiment related by Dr. Wistar. A calf was bled till nearly all its blood was evacuated and syncope induced; in this state the blood of another calf was transfused into its veins, in consequence of which it soon recovered: into the jugular veins of the second calf, a large quantity of milk was introduced of the temperature of the blood of the animal; the heart which had ceased to palpitate, instantly gave three or four convulsive pulsations, and then ceased to beat for ever.*

The blood is carried by the arteries to all parts of the body, in different proportions; those parts which are the subjects of motion, particularly of the voluntary, receive a very large portion of the red blood; hence the muscles in proportion to their size, receive more red blood, than perhaps other parts, whilst those which are merely added to give shape to the body,

* Instituted by the Committee of Experiments of the Royal medical Society of Edinburgh in the session of 1785 and 1786.

dy, and attachment to its various parts, and which consequently require compactness only, as bones, ligaments, and tendons, have merely the serous and glutinous portions conveyed to them. Are we not then, from this fact authorized to conclude, that these globules serve some important use in the muscles? Surely we are.—The cause of muscular motion has long been a desideratum with the inquisitive physiologist;—a pons asinorum as it were, in the science. Dr. Girtanner of Switzerland was I believe, the first who boldly asserted, that “the oxygene was the cause of the irritability and life of organized bodies,”—and that “after it has effected this important part in the system; it is absorbed by the different stimulating substances, from the organized fibre.” He has supported this doctrine in a very ingenious and masterly manner; unbiaſſed by the prejudices existing among the learned. For my part I confess I am inclined to adopt the doctor’s theory; for,

1. Parts *naturally* irritable, appear to be so, in proportion to the quantity of red blood conveyed to them; for example the heart.

2. Parts *not* irritable, are, by the conveyance of red blood to them when in a state of inflammation, possessed of the highest degree of sensibility, and stimulability; as in the tender and morbid granulations of bones, ligaments and tendons: in this case, the nerves become preternaturally sensible, from the increased action of the blood vessels.

3. Contractility

3. Contractility may exist in those parts of the body which do not contain red blood; but not irritability—as in the lymphatics, whose action appears to resemble the elasticity of inanimate matter. And here I would not have it imagined that I suppose every part to which red blood is carried, to be possessed of irritability;—by no means:—the various glands for secretion, have a much larger quantity sent off to them, than what goes to the muscles, and yet they are not possessed of this property, which seems to be *altogether* the result of muscular texture; without which, and in no other part does it exist: wherever muscular fibre is, contractility is also; yet contractility can exist independant either of muscular fibre or red globules. This regards animated nature only; for vegetables we also find possess irritability, without having either red blood or muscular fibre: oxygene however they possess in large quantities; and the power of the allwise Creator is sufficiently evinced by producing on different species of organization, similar effects from the same cause.

I may here also notice the difference between irritability, and excitability or stimulability; the latter I would define to be, a property existing *throughout* the body, and capable of being acted upon by stimuli of *any* kind:—whereas irritability is a principle *exclusively* residing in muscular fibre; and producing the *effect* of voluntary motion, or muscular action, *solely*, by the stimulus of volition from the brain. In this respect it resembles the various organs of sense which all require the action of *peculiar* stimuli to produce their effects; besides which, both organs of sense, and muscular fibre, have other nerves for the purpose of sensation in the part itself:—hence

we might look upon muscular motion as the product of a *sixth* sense.

Probably this production of irritability is owing to some peculiar structure of muscular fibre by which it is enabled to produce from the oxygene, that effect or principle upon which the nerves may act to induce muscular motion. Oxygene therefore, if it does not of itself absolutely form the principle of irritability, seems at least to be a condition of its existence in muscular fibre.

The ingenious Mr. Fowler who has lately written upon animal electricity, says "that he is convinced from a number of experiments, that this influence so far from destroying the contractility of the muscles, has a tendency to preserve it." and adds, "*Oxygene* is, so far as I know, the only stimulus in nature whose effects are at all analagous:" perhaps then it may be found that this nervous fluid or animal electricity, is the oxygene itself, peculiarly modified by the moving fibres of the body.

Mr. Fowler has shewn that convulsions may be excited in the leg of a frog in which the circulation is unimpeded, and in which the nerve is tied, *much longer* than when the experiment is reversed.* It would seem then from considering these experiments, that an observation of Mr. Valli's may probably not be ill founded; viz. that those parts of the nerves hitherto looked upon as their extreme branches, are in fact, their origin. If so, the muscles may be looked upon as glands of a
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peculiar

* Page 121. 124. 126.

peculiar action, secreting from the arteries this animal influence, or irritability; and the nerves, as merely their excretory ducts. The ingenious Fourcroy has looked upon muscle in this light; The supposition is much strengthened by an observation of Dr. Monro,—that the size of the brain in man in proportion to his bulk, is much greater than in any other animal; being four times as large as that of an Ox, perhaps six times his size; This is doubtless for the exertion of those faculties which Man alone possesses. But then again, we do not find the nerves existing in the *same* ratio, but proportioned to the size of the animal, and to his organs of sense. This has sometimes led me to suspect that there are nerves whose office it is to convey sensation to the brain, and which originate in every sentient part of the body;—and others which originate in the brain, conveying volition to those parts of the body, which we wish to excite into action. The very great connection between the brain and heart renders it probable, for neither viscus can be much affected without disordering the other; though it may arise from a connection of the nerves going to the blood vessels of the parts.

The *substance* of the heart itself, possesses very few (if any) nerves; the cardiac nerves accompanying the coronary arteries, appear more necessary to the action of those arteries than to the heart itself; for its action is not accelerated by irritating those nerves, as Haller observes; neither is its motion affected if they be divided or destroyed. Even wounds of the *medulla spinalis*—the source of the nerves of the heart, do not alter its function. Haller, says it possesses but few nerves;

hence

hence its action must be excited by the stimulus of the blood on its irritable principle. Opium applied *externally* to the heart did not affect its motion; but it diminished muscular motion, when applied to the muscles or their nerves, according to Fontana and others. In apoplexy, all voluntary motion is suspended; yet the heart still continues its action, nay more, it is often increased.

I was much struck with the following passage in the new system of anatomy; "there is" says the author, "in the air, undoubtedly, a certain electrical principle, which being by respiration communicated in different ways with the body, imparts a natural tone to the fibres, occasions a quicker motion in the vessels, and increases and diminishes by turns the alacrity of the mind,"* Here then are contained in a few words, the principal effects of oxygene; though the author was ignorant of it, and could not apply the facts he has stated. Dr. Cullen gives a case in which the feeling of the hand was lost, owing to a palsy of the brachial artery, whose pulsations gradually ceased from the wrist to the armpit†: here evidently, as the nerves were uninjured, is a convincing proof that some portion of the blood is absolutely necessary to the purpose of sensation, *independantly* of the nerves.

From many considerations, I am frequently led to believe with Mr. John Hunter, that vitality does exist in the blood:—it appears strange that from an inanimate mass, all the vital parts of the body should be produced,—or that Providence should make

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* V. 2. p. 256.

† Mat. med: V. I. p. 75.

so large a quantity of fluid necessary to our existence, if something more than *merely* the nourishment of our bodies was not intended thereby; as this expends but a comparatively small proportion of it. It is also rendered extremely probable by the experiments of Fontana and others on the effects of poisons: These when injected into the blood vessels in the minutest portion, caused instant death; whilst no effect was produced by them if taken *into* the stomach, or placed by the side of a nerve, or in contact with its divided extremity. Even that mild fluid, milk, has the same fatal effect. To these facts Mr. J. Hunter's own experiments might be added:—And a part of his 5th argument may be adduced also, in a particular manner, “the blood” says he, “preserves life in the different parts of the body. When the nerves going to a part are tied or cut, the part becomes paralytic, and loses all power of motion, but it does not mortify; if the artery be cut, the part dies, and mortification ensues”. We have likewise the assurance of the scriptures, that “the life of the flesh is in the blood.” and Dr. Seybert's ingenious experiments shew, that no change took place in the physical properties of the blood of animals, in consequence of starvation,—a putrid diet,—or the injection of putrid and other substances into the blood vessels;—although it mostly caused the death of the animal: The solids were the parts chiefly affected.* If therefore, I were to conclude that a principle of vitality existed more in one part of the body than in another, I should be much disposed to think the blood was that part.

* Inaugural dissertation.

If the above account of the destination of the oxygene is not satisfactory; or if it be supposed that our muscles cannot consume it all; I say that a quantity is constantly escaping from the body, combined with hydrogene and caloric in the form of perspiration, which although insensible, is in a large proportion; another portion combines with the carbone, which, like the hydrogene, is formed during the circulation, and is “convey’d away from all parts of the body by the pores, according to the experiments of the Count de Milly, and the observations of Mr. Fouquet.”*

Having thus attempted an explanation of some of the phenomena attending respiration, I shall now just say a few words on the probability of the existence of muscular fibres in the arteries. I have asserted above, that they are stimulated by the oxygene in the blood, during its circulation, in which they assist by the contraction thereby excited in them: I am induced to consider this subject because many have disputed the existence of muscular fibres, in arteries, and ascribe the circulation wholly to the contraction of the heart. My reasons for believing in their existence, are,

1. The force of the heart alone, is inadequate to propel the blood to the extremities;—this assertion is much strengthened by the case I related from Dr. Cullen;† here the circulation did not go on, although assisted by a vis-a-tergo.

2. Arteries which have been tied up, propel the blood into their corresponding veins by their own action; here no assistance

* Chaptal. V. 1. p. 138.

† Page 25.

assistance is derived either from the action of the heart, or from a vis-a-tergo.

3. From finding the arteries empty after death, in consequence of their own action, by which the blood is propelled into the veins.

4. From the strength with which the blood is ejected from those arteries which are tied up, and divided below the ligature.

5. From the circular appearance of divided arteries in life, and also after death; now in the human body, but three things are capable of producing this effect; viz. bone, cartilage and muscular fibre; and as the two former have never been detected in the structure of arteries, we must ascribe it to the latter.

6. From finding no valves in the arteries; the contraction of their own muscular fibres being equal to the propulsion of the blood: this is not the case with the veins, or, not in so great a degree, at least in the smaller ones; they therefore require the aid of valves, and also of a vis-a-tergo; thus resembling the lymphatics, which however possess valves in greater numbers.

7. Various experiments made by Mr. Verschuur prove the irritability of arteries; if therefore what I have said respecting irritability, be true, the arteries must consequently possess muscular fibres.

8. From the following fact by Mr. Hewson; noticed in dissecting an ass. "The arteries" says he, "of this, like those of other animals, have a strong elastic coat, which coat after distention contracts them again to a certain

certain degree ; but this contraction never goes so far as to shut up the cavity of the artery, and as it acts equally in the dead as in the living body, large arteries are therefore found with considerable cavities. But in this ass which I bled to death, the arteries contracted *more* than their elastic coats were capable of doing ; for those of the kidney were without a cavity and resembled a cord ; and that this contraction was muscular appeared upon distending them again, in which case they stood open as they commonly do in dead bodies. This fact will help us to explain why the arteries appear empty in dead bodies ; which may be owing to their muscular fibres having (before death) contracted to the degree seen in this animal, by which means all the blood was driven into the veins ; but these muscular fibres ceasing to act after death, the elastic fibres overcome that contraction, and expand the arteries which therefore appear empty." He afterwards adds, " Since writing the above, I have dissected a still born child which was defective in many parts of the body, and in particular in having no heart. In this child the circulation had been carried on *merely* by an artery and a vein whose coats therefore probably were muscular."*

From what has been said, we may easily see how important a part the oxygene acts in the body : its uses we find are numerous ; It will lead us to account for that fact mentioned by Hervey, viz. that the punctum saliens or pulsation of the heart, in a chick, was not evident till the appearance of the red globules ; hence the blood has been with propriety denominated, the " primum vivens, ultimum moriens." As it is the oxygene

* Experimental inquiries into the Lymphatic system in note of p. 14.

gene which is the cause of the redness of the blood, I may probably be asked, how oxygene can enter into an egg? I answer, that experiments made by myself and others, * prove that portion of air which we always find in one end of the egg, to be oxygenous gas,—and that it is vitiated, in proportion as the chick arrives to maturity;—I confess myself totally ignorant of the manner of its decomposition, and conveyance to the chick:—but, I may also mention, that it seems to render the theory I have given of the formation of the red globules very plausible; as we find this gas to be in contact with the white of the egg, which is known to resemble in many respects the serum of the blood.

That oxygene should act as a specific stimulus upon the arterial system, will not surprise us when we reflect how many substances act specifically on the different systems of our body; some on one only; others on a greater number; I shall mention two or three examples;—Mercury acts specifically upon the lymphatic and glandular systems;—*Asa fetida* chiefly on the nervous, and oil of Amber upon muscular fibre; whilst Opium acts upon them all.

We may be enabled here to explain the reason of the quickness of the pulse in new born infants, and which gradually diminishes as they increase in age. In the uterus we know they are supplied only with venous blood from the mother, which is however sufficiently stimulating to their tender frames, when combined with the heat of the mother; but, after birth being deprived of this heat, another source of it becomes necessary, which is effected by respiration:—their vessels also are

now

* J. Jeffray—*Dissert: Inaug: de Placenta.*

now acted upon by the *new* stimulus of arterial blood, instead of that conveyed to them by veins.

I formerly stated the difference between arterial and venous blood; and made it to consist in three particulars:—the first of which was the more fluid consistence of arterial blood;—this appears to be owing to the less quantity of carbonaceous matter in it, and which it had gained in its passage through the veins: the second, has been already fully treated of; and with respect to the third, it is fully evinced by the following experiment, related by my very ingenious and worthy fellow candidate, Mr. T. Drysdale,—“Equal quantities of blood were taken from the left ventricle of the heart and from the vena portæ of a dog, and exposed to the air in open vessels; putrefaction took place in that portion of blood drawn from the left ventricle *much* sooner than in the other portion drawn from the vein:—at the same time an equal portion of bile from the same animal, was exposed, which putrefied much later than either.” Now chemistry teaches us that putrefaction cannot go on, without the presence of pure air; hence, as arterial possesses a proportional greater quantity of oxygene than venous blood, putrefaction must go on with proportionable celerity.

I have thus endeavoured to explain some of the wonderful phenomena of the animal œconomy; If I have been successful, it will afford me the highest satisfaction; if otherwise, I shall at least have afforded my mite towards the investigation of truth, by removing a portion of error which obstructed our passage to her

distant and deep recesses. I proceed now in order, to treat of,

INFLAMMATION.

I shall first consider the various theories which have at different times prevailed upon this subject.

The first, of any consequence which we find, is Bellini's; who makes it to consist in a LENTOR or OBSTRUCTION of the extreme vessels which contain red blood; in this he was followed by Boerhaave; the doctrine has however, in my opinion, been completely refuted by Dr. Cullen;* and actual experiments prove, that no such obstruction does occur; these were made on the pellucid web-like substance of the feet of frogs, which were inflamed by irritating them, and by the aid of the best glasses, the blood appeared to pass with *greater* velocity than before.

This doctrine seems to have arisen from the appearance of the buffy coat on blood drawn in inflammation, and which was supposed to be caused by a preternatural spissitude of that fluid; however it is now well known from the experiments of Mr Hewson, that in inflammation, the blood is of a *thinner* consistence than usual;—and in this manner he accounts for the appearance of the buff;—for the blood being longer in coagulating, the gluten or coagulable lymph permits the red globules to precipitate, so as to leave this white tenacious substance at the superior part in full view.—This change which takes place in the blood appears to be
owing

* First lines v. I. §. 244.

owing to some *peculiar* action of the vessels upon it; and we may reasonably conclude, that the convulsive action of the arteries must considerably influence their circulating fluids. The *dissolved* blood which often appears in very violent inflammatory fevers, seems to be owing to the excess of inflammatory diathesis in the system, by which the blood is rendered still thinner, and *less* capable of coagulation than in less violent inflammations; no more occurs here, than what also takes place in gangrene and sphacelus from the same excess. The dissolved state of the blood in a Typhus fever, seems the effect of a diametrically opposite cause; viz. the great direct debility existing in the system, thus also is it with gangrene which occurs from the debility of the part: It only shews that the same effect may be produced from very different causes; hence the spontaneous hemorrhagies in violent inflammatory and in low typhus fever; and hence I would account for the appearance of petechiæ, vibices, and maculæ, which are certainly *often* the product of *excessive* inflammatory action, and are removed by blood-letting. Of this we have a very remarkable instance in the writings of the celebrated Dr. Sydenham†: and some similar facts occurred during the late destructive epidemic in our city.

A second cause of inflammation proposed by Boerhaave, consisted of OBSTRUCTION from ERROR Loci, or the “passage of blood out of its proper vessels into those which contain more subtil juices;”‡ hence says Boerhaave, “the seat of an inflammation may be as well in the arteries themselves, as in the veins, nerves, membranes,

† V. I. p. 264. of a new edition by Wallis.

‡ Boerhaave's aphor. §. 372.

membranes, muscles, glands, bones, cartilages and tendons, with all the viscera.”* Dr. Cullen in his attack upon this second theory is not so successful as upon the former; for he confesses that error loci may *sometimes* be a cause of inflammation; I would only wish to observe, that to suppose *more* than one proximate cause of any disease is unphilosophical; this however the Dr. has done, in supposing error loci to be capable of producing it; and then assigning one consistent with his own doctrine; “a spasm of the extreme arteries” says he†, “supporting an increased action in the course of them, may be considered as the proximate cause of inflammation; at least in all cases not arising from direct stimuli applied; and even in this case the stimuli may be *supposed* to produce a spasm of the extreme vessels;” in the latter part of this sentence we find the Dr. descending to supposition, and unnecessarily multiplying his proximate causes; now as it can be explained in a much more satisfactory manner; we shall pass over this, to take a view of the first part of the sentence, viz. that alluding to spasm; in which he wishes to prove the *probability* of the constriction in the extreme vessels, with an increased action in the other parts of them, and adduces rheumatism as a proof of it. This “says he, “is a species of inflammation which is often manifestly, produced either by cold applied to over-distended vessels, or by causes of an increased impetus, and over-distention in vessels previously constricted. Hence the disease especially appears at seasons liable to frequent and

* Boerhaave's aphor: §. 374.

† First lines § 245.

and considerable vicissitudes of heat and cold.”* But I cannot agree altogether with the Dr. for although it is owing to considerable vicissitudes of weather, at which time more or less of the phlogistic diathesis exists in the system, still, only such parts are attacked, as are previously debilitated by the action of cold, or of any other cause capable of inducing this debility: hence, the same phlogistic diathesis existing in the system, would particularly shew its effects, as pneumony, if the lungs or pleura were *most* debilitated:—as catarrh, if the mucous membrane of the nose and fauces; and as rheumatism, if the joints or muscles were in that state. In fact, there exists no difference between pneumony and rheumatism, independantly of the seat of the *local* inflammation; one being in the lungs or pleura; the other in the joints or muscles; both are accompanied by an inflammatory fever; and both require the same mode of treatment. This I conceive to be a much more simple and natural mode of accounting for it, than by bringing to our aid the VIS MEDICATRIX NATURÆ; a thing we know nothing about, and which appears to be only the revival of Dr. Stahl’s presiding spirit, which no physician of the present day allows to exist.†

Further, in support of spasm, the Dr. adds, “that the parts of the body most frequently affected with inflammation, are those exposed, both to over-distention, from a change in the distribution of the fluids, and, at the same time,

* First lines § 246.

† Indeed with equal propriety might we suppose the existence of a *Vis Medicatrix Naturæ* in trees or shrubs: because, upon any injury done to them by bruising or cutting off a part, an exudation similar to a callus takes place, to defend them from the action of external causes.

time, to the immediate action of cold. Hence quinaries, and pneumonic inflammations, are more frequent than any other.* This also, without recurring to spasm, we may account for, by our knowing that those parts are more liable than any other, to be debilitated, from the alternate action of heat and cold upon them;—as soon therefore as this debility is induced, inflammation and its consequences ensue, and in a very short time produce the phlogistic diathesis in the system, if it does not already exist there.

But exclusive of the greater simplicity of this mode of accounting for those diseases, I do not find that the existence of spasm has ever been demonstrated; indeed the doctrine appears to be daily declining; and will, doubtless, be soon entirely exploded. Not to mention the contradictions existing throughout the theory, I shall only ask, how an increased action, can exist in the course of the blood vessels, while spasm of the extreme vessels, is present? Can we suppose this increased action of the larger vessels unable to overcome the spasm of the extreme branches? But, we are told that the spasm prevents the free passage of the blood through the extremities of the arteries; if this were true, would not such an accumulation of the blood take place in the arteries, as to cause death in *one* paroxysm of a fever? for every pulsation would add to the quantity *already* clogging up their extremities, and the quantity conveyed by the veins to the heart, would very soon be insufficient for the purpose of circulation.

But

* First lines § 246.

But here, whilst thus endeavouring to bring truth to light,—let us not forget the many obligations which medicine is under to the illustrious Cullen.—His great and penetrating genius led him to make discoveries in our science. May his Name be immortal!

Another doctrine which has been advanced, is that of OBSTRUCTION producing IRRITATION; but this I can by no means allow to be the proximate cause of inflammation,—although it may doubtless assist much in producing it, by acting as a *remote* cause, in debilitating the part. But by stating my own ideas of the subject, the objections to the various doctrines will I hope be more clearly seen,—and here I would wish to be understood as treating of inflammation as it generally makes its appearance in Phlegmon; although with Boerhaave I think the term applies to every case, in which any fluid escaping out of its *proper* vessels into such as naturally contain a finer fluid, thereby produces error loci, and convulsive action of the vessels of the part, which by sympathy, or by the irritation induced, may affect the smaller and *serous* vessels, and by debilitating them, produce an error loci of *red* blood, which will ultimately induce a *true* phlegmonic inflammation.

The definition of phlegmon as given by Mr. Bell, appears to be as just as any; viz. “phlegmon is a circumscribed tumour, attended with heat, redness, tension and a throbbing pain, and, if extensive, with fever.” A small inflammation of long continuance, will however induce fever in the system, by sympathy in the muscular fibres of the arteries; this I have observed to be the case in an inflammation of the extremity of the
finger,

finger, brought on by merely pulling off a piece of the skin at the nail, known by the name of a *mother in law*; this is however by no means always the case; I only mention it, because such is sometimes the consequence:

With respect then to the PROXIMATE cause of inflammation, I look upon it to be a convulsive or irregular action in the vessels of the part, often by sympathy bringing the whole arterial system into action; and thereby inducing the phlogistic diathesis; this diathesis may exist however, independantly of topical affection, and then it shews itself as a simple inflammatory fever; though this is seldom the case, for some part will generally be in a state of greater debility than the rest of the system; owing to greater exposure to cold or other debilitating causes; from which circumstance, the effects of the circulation will be felt in that, rather than in any other part; hence, according to the part on which it acts, will occur pneumony, rheumatism, &c. of different degrees of violence, proportioned to the acting causes. All the phenomena which take place in inflammation, evidently shew the existence of irregular action in the part.

OF THE REMOTE CAUSES OF INFLAMMATION.

With respect to the remote causes of inflammation, I cannot do better than admit of the division made by Dr. Cullen; and therefore shall quote him in his own words.

“ The

“The remote causes of inflammation may be reduced to five heads.

1. The application of stimulant substances; among which are to be reckoned the action of fire, or burning.

2. External violence operating mechanically in wounding, bruising, compressing or overstretching the parts.

3. Extraneous substances lodged in any part of the body, irritating by their chemical acrimony or mechanical form, or compressing by their bulk or gravity.

4. Cold in a certain degree, not sufficient immediately to produce gangrene.

5. An increased impetus of the blood determined to a particular part.”*

Whoever takes a view of these remote causes, must perceive that they allevidently act by inducing DEBILITY in the part, before inflammation can take place: indeed, their chief action is that of debilitants; by which they give an opportunity for the action of the EXCITING cause of ERROR LOCI; This, in true phlegmonic inflammation consists of red globules passing into ferous vessels; which they quickly excite into action by their excess of stimulus, and by sympathy or irritation, the surrounding ones are soon brought into the same state.

F

I maintain

I maintain therefore, that without error loci, inflammation *cannot* exist; and that error loci *cannot* take place till the part is debilitated: hence in proportion to the violence of opthalmia is the error loci: "I have even sometimes observed" says Van Swieten, "in the worst species of opthalmia a vessel full of red blood passing through the very pellucid substance of the cornea, conspicuous even to the naked eye."*

This error loci may take place either,

1. From a laxity in the vessels of the part, unaccompanied by any greater momentum in the force or velocity of the blood.

2. From an increase of the blood's momentum; by which a greater quantity is sent to a particular part in a given time than ordinary, which first debilitates that part, and renders the vessels incapable of withstanding the afflux of blood; hence error loci and its consequences ensue; or,—

3. It may take place from a combination of both the above mentioned causes.

To sum up then in a few words my ideas of inflammation: The remote causes act by inducing debility; hence, error loci takes place, which acts as an exciting cause upon the accumulated excitability of the debilitated muscular fibres of the arteries; and thereby produces convulsion or irregular action in the vessels of the part.

The heat observable in Phlegmon may arise either from latent, converted into sensible heat:—or from the
part

* Comment. on Boerhaave's aphorisms.

part becoming a better conductor of that subtil fluid ; in consequence of which more is conveyed there, in a given time.

The redness, is doubtless owing to red globules being forced into serous, and more superficial vessels.

The tension and swelling, are owing to the obstruction in the vessels ; And the throbbing pain in the part, to the increase of sensibility in the nerves of the part, from inflammation, and from the small vessels becoming evidently pulsating from the increase of the circulation.

OF THE TERMINATIONS OF INFLAMMATION

If inflammation be cured without loss of substance, and while the state and texture of the part remain entire ; the disease is said to terminate by RESOLUTION.

This mode of termination takes place only, when the inflammation has been moderate, or properly treated in time, and when the error loci and consequent convulsion of the vessels of the part have not been carried to excess ; whereby the vessels gradually recover their tone, and the part returns to its original healthy state.

It sometimes happens that the inflammation has been suffered to run on ; in consequence of which, an effusion of matter generally takes place into the surrounding cellular substance ; This, may be only a larger quantity of the ordinary exhaling fluids ; which, when a free circulation is restored, is readily absorbed, and the part left in its former healthy state. The inflammation in this case, may be said to terminate by RESOLUTION.

But

But if from the excess of inflammation and violent impetus of the blood, the vessels are ruptured and their contents poured out ; a reabsorption does not so readily take place, but the fluids suffer a particular change ; being converted into a matter called Pus ;—at the same time an abatement of the redness, heat and pain take place, and the disease is now said to terminate by SUPPURATION. The part containing this collection of pus is called an ABSCESS. The absorption of matter by the lymphatics, and conveyance of it to the lungs, has very unjustly, been supposed a cause of hectic ; this fever however only occurs in consequence of the *excessive* discharge from an ulcer, as in the psoas abscess, which evidently proves it to be the effect of the great debility induced thereby : besides, the lymphatics do not convey their contents to the lungs, but to the venous system.

There have been many disputes respecting the formation of Pus. Some ingenious authors having looked upon it as a secretion :* whilst others with equal ingenuity have endeavoured to shew it to be the effects of a *particular* fermentation. To this last opinion I profess myself a convert ; and, for the following reasons.

1. If it be not so, we must suppose the vessels of the part to be *very* suddenly endowed with a secreting power ; and with a *very* different action from their former one.

2. Because we do not find the least analogy between these vessels, and those of other parts which *do* secrete particular

* Dr. Morgan late Professor of the Institutes of Medicine, in his elaborate thesis “De Puopioesi.”

particular fluids. We know that for any secretion to go on, a surprising and wonderful convolution of the secretory vessel is necessary; now this is by no means the case with those vessels which have been supposed to secrete pus.

3. Because we can account much more rationally for its formation, in supposing it the product of fermentation of a *peculiar* kind; which I shall take the liberty of denominating, the SUPPURATIVE fermentation.

It may be here asserted, that but three species of fermentation exist; the vinous, acetous, and putrefactive. There is no person more disposed to simplify nature than myself; nevertheless, I think it may be carried much too far,—as in the present instance;—We should be cautious of flinting her in her operations.—We all know that for the production of those three species of fermentation, a combination of certain substances is necessary; thus a saccharine matter is absolutely requisite in the vinous; a mucilage in the acetous: and a gluten in the putrefactive state. Why then may not a combination of *other* substances produce a fermentation of a specific kind?

That wonderful action of the arteries by which those which go to a bone, do, in case of fracture, pour out a boney substance:—those which go to muscle, or tendon, in case of injury, pour out the same kind of matter; is by no means an objection to this theory; it seems to be an original part of their constitution, as much as the secretion of urine by the kidneys; or of semen, or saliva, by their appropriate glands; besides these substances exist

exist *materially* in the blood, and only require the aid of the arteries of the injured part to deposite them where necessary; But this is not the case with pus; which is uniformly, a homogeneous mass, formed from a mixture of heterogeneous substances, and in this respect resembles a product of fermentation.

Let us just take a view of the requisites for fermentation to go on properly. These are, rest; a certain degree of heat; moisture, and the presence of oxygene or of vital air.

Now are not all these requisites present in the fluid poured out from the vessels?

That the particular part itself is at rest, even though situated where most motion is allowed of, will not be denied.

The heat appears of a just degree, for the proper production of fermentation.

Moisture exists in sufficient quantity; as also does oxygene which is given off by the decomposition of the red globules. That they are decomposed, is evident from seeing the redness of a phlegmon gradually diminish as suppuration advances; and finding nothing but a mild pus, upon opening the abscess, when *fully* ripe; otherwise a considerable portion of red blood is mixed with it:—an experiment also of Mr. Everad Home, related in his treatise upon the properties of pus,† strengthens this assertion very considerably. “The *câput mortuum*” says he, “of distilled pus shewed a

polarity

† P. 26.

polarity with the magnet, by heating it for eight hours in a crucible, in a reverberatory furnace ?" indeed, to me, it is a positive proof of their decomposition, as no other portion of the blood contains any iron.——

From all these facts, I think myself justified in regarding pus as the product of a *peculiar* fermentation.

It would appear that for the formation of pus, serum and red globules were only necessary ;—for when any others matters are poured out ; or, when these are in undue proportions, a *pure* pus is not formed. The solid parts are not in the least broken down or eroded, in the formation of laudable pus ; we see amazingly large quantities frequently formed, even in so small an ulcer as an issue, without the least destruction of the surrounding solids ! it may perhaps appear an exception to this assertion, that in deep seated abscesses, the fluid gradually approaches the surface ; while the intermediate solids are removed. This however may be better explained upon the principles of absorption, caused by the pressure of the contained fluid. Why a deep seated abscess should point *outwards*, appears mysterious ; perhaps it may arise from the pressure being *least* at that part ; for we find abscesses of the liver frequently discharge themselves into the stomach or intestines, if seated on its concave surface ; but through the diaphragm into the lungs, if on its superior or convex surface ; in both which cases there is less pressure made on that, than on the opposite side : a *moderate* degree of pressure or inflammation increases absorption ; but a more considerable degree entirely checks it.

The

The use of pus which is a mild, bland fluid, is evidently to compose a bed for the elongation of vessels, and thereby to form an union between the separated portions of flesh. From this, it would appear highly improper, in an ulcer in which laudable pus is produced, to wash and wipe it off daily; for by this means, the tender granulations of new flesh are also destroyed, and the healing of the ulcer is much protracted. Where the pus is not good, it ought evidently to be removed, as otherwise it will injure by its acrid quality: but I cannot perceive the propriety of removing a healthy laudable pus; which being a mild and inoffensive fluid, and wisely ordered for the elongation of vessels, surely cannot be so prejudicial to a wound as its frequent removal.

Many instances have occurred of its remaining in contact with the sore several days, unexposed to the air, without the least detriment; and being perfectly sweet and inodorous when the wound was opened; but soon contracting a putrid smell by exposure to the atmosphere.

It frequently happens, either from the extreme violence of the inflammation; or from some peculiar acrimony of the fluids of the diseased part; or from very great debility in the part, so that the degree of inflammation, necessary to the production of pus, cannot take place, that the effused fluids are affected with a state, approaching more or less to putrefaction; when this is moderate in degree, and affects chiefly the fluids effused, the parts are said to be in a state of **GANGRENE**; but if the solids also become affected

fectcd, the disease is then termed SPHACELUS or MOR-
TIFICATION.

It is not necessary for Gangrene always to be preceded by suppuration : of which a remarkable instance is mentioned by Van Swieten.*

It appears in every instance, that before Sphacelus can take place in a part, it must be preceded by the death of that part ; for as sphacelus appears to be of a putrefactive nature ; and as no degree of putrefaction can take place in the living body, the above conclusion follows of course ; Hence the propriety of Dr. Seybert's supposition, that the fætor of the urine, breath and other excretions of persons, labouring under diseases, (*improperly*) called putrid, become so in their respective reservoirs *after* their separation from the general mass. The whole system is notwithstanding, frequently brought into sympathy by this local putrefaction as is evident from the weak and quick pulse, nausea, vomiting, diarrhea, delirium, convulsions and death, sometimes induced by it.

“ In inflammation,” says Cullen, “ the tendency to gangrene may be apprehended from an extreme violence of pain and heat in the inflamed part, and from a great degree of pyrexia attending the inflammation.

“ The actual coming on of gangrene may be perceived, by the colour of the inflamed part changing from a clear to a dark red ; by blisters arising upon the

G part;

* Comment. on Boerhaave's Aph. § 389.

part ; becoming soft, flaccid, and insensible ; and by the ceasing of all pain while these appearances take place.

“ As the gangrene proceeds, the colour of the part becomes livid, and, by degrees, quite black ; the heat of the part entirely ceases ; the softness and flaccidity of the part increase ; it loses its consistence ; exhales a cadaverous smell ; and may then be considered as affected with sphacelus.”*

A fourth mode of the termination of inflammation is in what is commonly called, SCHIRRUS ; or an indolent hardness of a part. This termination appears to be *wholly* connected with glandular parts ; as the nose, mouth, breast, testes, uterus, liver, spleen, &c. but not lymphatic glands, unless secondarily affected, by absorbing diseased humours. Hence, it is of no use to extirpate a cancerous breast, unless we can entirely remove the infected glands ; as the cancerous humour left behind, will most certainly renew the disease—and generally with redoubled violence. I do not recollect a single instance of any but glandular parts being affected by a *true* schirrus ; for though every part of the body is occasionally liable to preternatural bulk and hardness, still it should be distinguished from schirrus ; as the term has been *very* vaguely applied to these preternatural swellings.—Schirrus appears therefore to be entirely owing to the peculiar structure of the part.

These

These tumours if produced slowly will remain for years, nay, even during a long life, without any pain or trouble to the patient. They are then termed indolent. —Care, however is necessary to prevent the action of any exciting cause upon them, for if inflammation take place in their vessels, they become *incipient* cancers; which should be removed as soon as possible by proper remedies, when, they are generally attended with success, if no schrofulous or venereal taint exists in the system; if so, these affections should be first removed, as they tend greatly to promote a return of the disease.

These Schirri may arise, not only from the effects of inflammation, by which they frequently become organized, and incapable of being conveyed away by the absorbents; but also from a languor in the circulation, and debility, of the vessels of the part.—These two very opposite causes affect the system, however, in the same manner.

Dr. Cullen has enumerated some other terminations of inflammation, as “the effusion of a portion of the entire mass of blood, either by means of rupture or of an anastomosis, into the adjoining cellular texture.” Under this head might as well be classed all the cases of active hemorrhagies accompanied with pyrexia; as the blood is only thrown out of the body, instead of being effused into the cellular texture.

Another kind of termination which he mentions, is “that of certain inflammations on the surface of the body, when there is poured out under the cuticle a fluid, which being too gross to pass through its pores,

therefore

therefore separates it from the skin, and raises it up into the form of a vesicle containing the effused fluid;" and again, "when the internal parts are affected with inflammation, there seems to have been almost always upon their surface an exudation, which appears partly as a viscid concretion upon their surface, and partly as a thin serous fluid, effused into the cavities in which the inflamed viscera are placed." I think the Dr. might with equal propriety, have swelled the list of these terminations of inflammation, by the addition of dropsy which often follows the inflammation of a part; for as they do not *always* take place; and as the four general terminations which I have mentioned above, are, perhaps ninety-nine times out of an hundred, the only ones; instead of simplifying, it only increases the difficulties already attending the study of medicine.

OF THE CURE OF INFLAMMATION.

The indications of cure in inflammation must differ considerably, according as one or other of the terminations above-mentioned, predominates.

It must be evident that if possible, the cure should be attempted by RESOLUTION, as the most desirable method; for which purpose, we must,

1. Remove the remote causes if they are evident, and continue to operate.
2. Take off the phlogistic diathesis affecting either the whole system, or the particular part,

3. Restore

3. Restore the tone of the part, by remedies applied, either to the whole system, or to the part affected.

The first indication is effected, by our knowledge of the remote causes which operate.

The phlogistic diathesis may be taken down or diminished by, blood letting, both general and local;—purges, of neutral salts, or of the more drastic kind if necessary; nitre and the antimonial preparations; with the other parts of the antiphlogistic regimen; particularly the application of cold, as cold air to the whole body; cold water or vinegar—and ice or snow to the part affected; the saturnine applications may also be used; preventing or diminishing the flow of blood to the part, by compressing the artery, if practicable, will be of great advantage, as the increase of inflammation is prevented by lessening the vis a tergo.

The tone of the part is to be restored by astringents and stimulants topically applied; and by tonics taken internally, upon the abatement of the inflammation.

When however, we find all our endeavours towards a cure by resolution, fruitless; and when we find evident advances towards SUPPURATION; we must immediately leave the foregoing remedies, (unless too much action in the system authorizes their moderate use, as is often the case, and which would tend to prevent a proper suppuration;) and endeavour to promote as speedy a suppuration as possible. This is effected by such applications as support a proper heat in the part; and by their emollient qualities relax the vessels; by

which

which means their contents are more easily discharged, and Pus is formed therefrom.—And for this purpose, nothing is better than fomentations of flannels pressed out of any warm emollient decoction; applied as warm as the patient can bear them, and frequently repeated; continuing them for half an hour at a time: after which, a warm bread and milk poultice to the part *frequently* renewed in the course of the day, will generally produce the desired effect.

Respecting the proper time and mode of opening abscesses, Mr. Bell has treated so fully, as to render it unnecessary for me to say any thing on the subject.

If however the appearance of GANGRENE is perceived, we must endeavour to check its progress by every means in our power; and this must be determined by the judgment of the physician: together with a knowledge of the causes tending to produce it.

When gangrene has begun to take place, its increase may often be prevented by the separation of the dead from the living part; this is most effectually done by the knife, but if it cannot be conveniently applied; and if the gangrene arises from defect of action in the part, it is best effected by exciting inflammation and suppuration on the verge of the living part, by various antiseptics both externally applied and taken internally; The external applications are rendered more certain in their operation, if the part be previously scarified; these should come in contact with the sound parts, which, the stimulating applications will then mostly be sufficient to excite into action. Great care must be taken

to avoid the blood vessels and nerves in scarifying the part.

I well know that Mr. Bell has asserted that, "from scarifications, and the subsequent applications of antiseptics, he never derived any advantage;" The practice to me appears founded in reason, and has many eminent men as advocates in its favour; I would therefore ascribe his want of success to his having employed scarifications in that species of gangrene which arises from *excess* of inflammation; in which species, moderate bleedings, and gentle purgatives are useful; and topical bleedings with leeches would be highly serviceable to allay the local inflammation.

The medicines to be taken internally, in the species which arises from a want of tone; are bitters, peruvian bark, columbo root, port wine; and elix: vitriol; And here our great dependance should be upon the bark; which should be given in much larger quantities than is often done; our only guide must be the patient's stomach; and we may use it at the same time in the form of glysters, combined with port wine, and laudanum, to prevent its running off too speedily by the bowels.—Amputation should *never* take place, till the mortified parts are separated from the living, or at least till suppuration appears on the verge of the sound parts, as the gangrene seems only to be hastened by it otherwise.

OF THE PROGNOSIS OF INFLAMMATION.

Boerhaave has comprised all that can be said upon this subject in a few words; "the prognosis of an inflammation"

flammation" says he, "is deduced from considering its cause, part affected, magnitude, depth, violence, the habit of the patient, the several symptoms; and by comparing these with the demonstrative signs and effects or consequences of the inflammation."*

It may perhaps be necessary for me to notice in this place, the arrangements of inflammation as mentioned by different authors.

Cullen says, "the difference of inflammation arises chiefly from the difference of the part affected; I have therefore arranged them, as they are CUTANEOUS, VISCERAL, OR ARTICULAR, &c." I agree with the Dr. in the former part of this sentence, but I prefer the arrangement of Dr. J. Carmichael Smyth, as being more natural and complete; He treats of it as affecting,

"1. Diaphanous membranes; as the pleura, &c.

2. Mucous membranes; as of the nose, fauces, &c.

3. Cellular membrane; as in phlegmon.

4. Muscular fibre; as in rheumatism.

5. The skin; as in erysipelas."

Perhaps to these might be added,

6. Parenchyma or the substance of the viscera.

Mr. John Hunter has divided inflammation into the *adhesive*, the *suppurative*, and the *ulcerative*; but this division appears erroneous, for, in his third species, there is frequently no evidence of inflammation:

on: and often in the suppurative, the same absence of it occurs.

From what I stated in some of the preceding pages, it will appear how very unnecessary it is to load the memory with such an useless *farrago* of names of diseases, as are to be found in most of the writings of medical authors: and that the only distinction necessary, is, their different *stages* or rather *states* of action; terming them, as the system partakes most of the inflammatory, typhus or typhoid action; and consequently directing our indications of cure, to the *existing* state of the system.

Having thus considered those subjects which I proposed treating of in the commencement of this inquiry, I cannot conclude without noticing the wonderful, yet uniform simplicity, existing throughout all the operations of nature, It clearly evinces the connection of truths; and that they are all links of one great chain, mutually sustaining, and strengthening each other. By the operation of a *single* cause, viz. the decomposition of vital air, and subsequent fixation of its base, we see the production of combustion; respiration, and its effects; the oxydation of metals, and fermentation. How can we sufficiently admire this amazing simplicity in the works of nature! Or, to speak more properly, how can we sufficiently admire and adore the wisdom of that BEING from whom this simplicity is derived.

“ *Nature in simple dignity appears,*

“ *And all her works a hand divine, declares.*

“ *We trace in nature’s most minute design,*

“ *The signature and stamp of power divine.*

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